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$$y^{\text{iv}} = \frac{(ab_1 - a_1b)[(a + bY')^2 Y^{\text{iv}} - 10b(a + bY') Y'' Y''' + 15b^2(Y''')^3]}{(a + bY')^7},$$

$$y^{\text{v}} = \frac{[105(a + bY')b^2(Y'')^2 Y''' - 105b^3(Y'')^3]}{(a + bY')^9} + \frac{(ab_1 - a_1b)[(a + bY')^3 Y^{\text{v}} - 15b(a + bY')^2 Y'' Y^{\text{iv}} - 10b(a + bY')^2 (Y''')^2 + 15b^2(Y''')^3]}{(a + bY')^9}.$$

From (2) we find

$$y' = Y - XY', \quad y'' = X^3 Y'', \quad y''' = -X^4(3Y'' + XY'''),$$

$$y^{\text{iv}} = X^5[12Y'' + 8XY''' + X^2 Y^{\text{iv}}]$$

$$y^{\text{v}} = -X^6[60Y'' + 60XY''' + 15X^2 Y^{\text{iv}} + X^3 Y^{\text{v}}].$$

It can be easily shown by substitution that each transformation leaves the given equation invariant.

Also solved by J. W. CLAWSON and GEO. W. HARTWELL.

349. Proposed by C. N. SCHMALL, New York City.

If $y = a \cos(\log x) + b \sin(\log x)$, eliminate the constants a and b and obtain the equation

$$\frac{x^2 d^2 y}{dx^2} + \frac{xdy}{dx} + y = 0.$$

SOLUTION BY C. C. STECK, New Hampshire State College.

By differentiating the equation $y = a \cos(\log x) + b \sin(\log x)$, we obtain

$$\frac{xdy}{dx} = -a \sin(\log x) + b \cos(\log x).$$

Differentiating this and multiplying the resulting equation by x , we get

$$\frac{x^2 d^2 y}{dx^2} + \frac{xdy}{dx} = -a \cos(\log x) - b \sin(\log x) = -y.$$

From the last two equations readily follows the desired result

$$\frac{x^2 d^2 y}{dx^2} + \frac{xdy}{dx} + y = 0.$$

Also solved by M. E. GRABER, J. B. SMITH, J. W. CLAWSON, P. PEÑALVER, C. HORNING, ELMER SCHUYLER, A. M. HARDING, W. W. BEMAN, A. L. MCCARTY, H. L. SLOBIN, CLIFFORD N. MILLS, FRANCIS RUST, I. A. BARNETT, F. C. REISLER, G. W. HARTWELL, S. W. REAVES, RICHARD MORRIS, ALBERT R. NAUER, BARNUM LIBBY, and WALTER C. EELLS.

351. Proposed by C. N. SCHMALL, New York City.

In the ellipse $(x^2/a^2) + (y^2/b^2) = 1$ are given e the eccentricity, and the angle φ which the normal at any point P (on the curve) makes with the major axis. If R is the radius of curvature at P prove that

$$R = \frac{a(1 - e^2)}{(1 - e^2 \sin^2 \varphi)^{\frac{3}{2}}}.$$